ARCHBOLD'S EDUCATION VISION

An Emerging Framework for K-12 and Public Outreach

Dustin Angell, 2024
Program Director of Education

Archbold

EDUCATION IN CONTEXT

This is a strategic vision for Archbold's educational outreach programs serving K-12 students and the public. It places these activities within the field station and environmental education context and identifies the most appropriate teaching strategies. The heart of the document is a theory of change diagram that sets out our approach to educational outreach. This vision also presents a plan for program evaluation and recommendations for staffing and resource needs.

A PROGRAMMATIC NORTH STAR

With this vision as a north star, we anticipate that Archbold's Education Program will effectively deliver quality science education that fosters a sense of place, a connection to nature, and an environmental identity. Additionaly, Archbold's strategy of place-based education, drawing from decades-long research projects and integrating research staff into educational outreach activities, represents a world-class model for effective field station education. Notably, this vision does not cover the full scope of Archbold's educational activities, like our work with college classes, conservation professionals, or the training of research interns.

Archbold's 4 Strategic Pillars

- Saving the rarest of the rare;
- Sustaining grasslands;
- Connecting large landscapes and wildlife corridors; and
- Addressing climate change.

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SECTION ONE

Archbold's Enduring Education Model

ARCHBOLD'S ENDURING EDUCATION MODEL

Archbold's Educational Program has served the local community for over thirty years. We offer a variety of on- and off-site in-person activities for K-12 and public audiences, and free online resources. Recently we've tentatively expanded our reach across the state and nation by adding live virtual events and interactive online activities. This emerging trend is coupled with a modest expansion of our staff. Our programs utilize an informal science framework for field stations and cover a range of topics that draw from our research, conservation, land, and history. In this section we present a "theory of change" aimed to center our educational outreach activities on our intermediate goals of fostering environmental identity, connection to nature, and a sense of place. We've also presented a new strategy for evaluating our programs.

ARCHBOLD'S EDUCATION PROGRAM TIMELINE

1 SEEDS OF EDUCATION 1957

First documented tour at Archbold.

2 INSTITUTIONALIZING THE EDUCATION PROGRAM 1980S-1990S

- Formation of Education Department (Nancy Deyrup, 1st Education Coordinator)
- Elementary School Program and The Real Florida, 1991
- Ecology Summer Camp, 1992
- Education Internship Program
- Volunteer Program
- Joined the League of Environmental Educators in Florida

3 DISCOVERING THE FLORIDA SCRUB, 2001

Full curriculum of outdoor activities, partly funded by the Florida Fish and Wildlife Conservation Commission.

4 NEW ERA OF COUMMUNITY ENGAGEMENT, 2011

- Learning Center opens December 2011 with trails and interpretive displays
- Offering public events and tours
- Creation of YouTube channel

5 COVID DISRUPTIONS AND VIRTUAL EDUCATION 2020

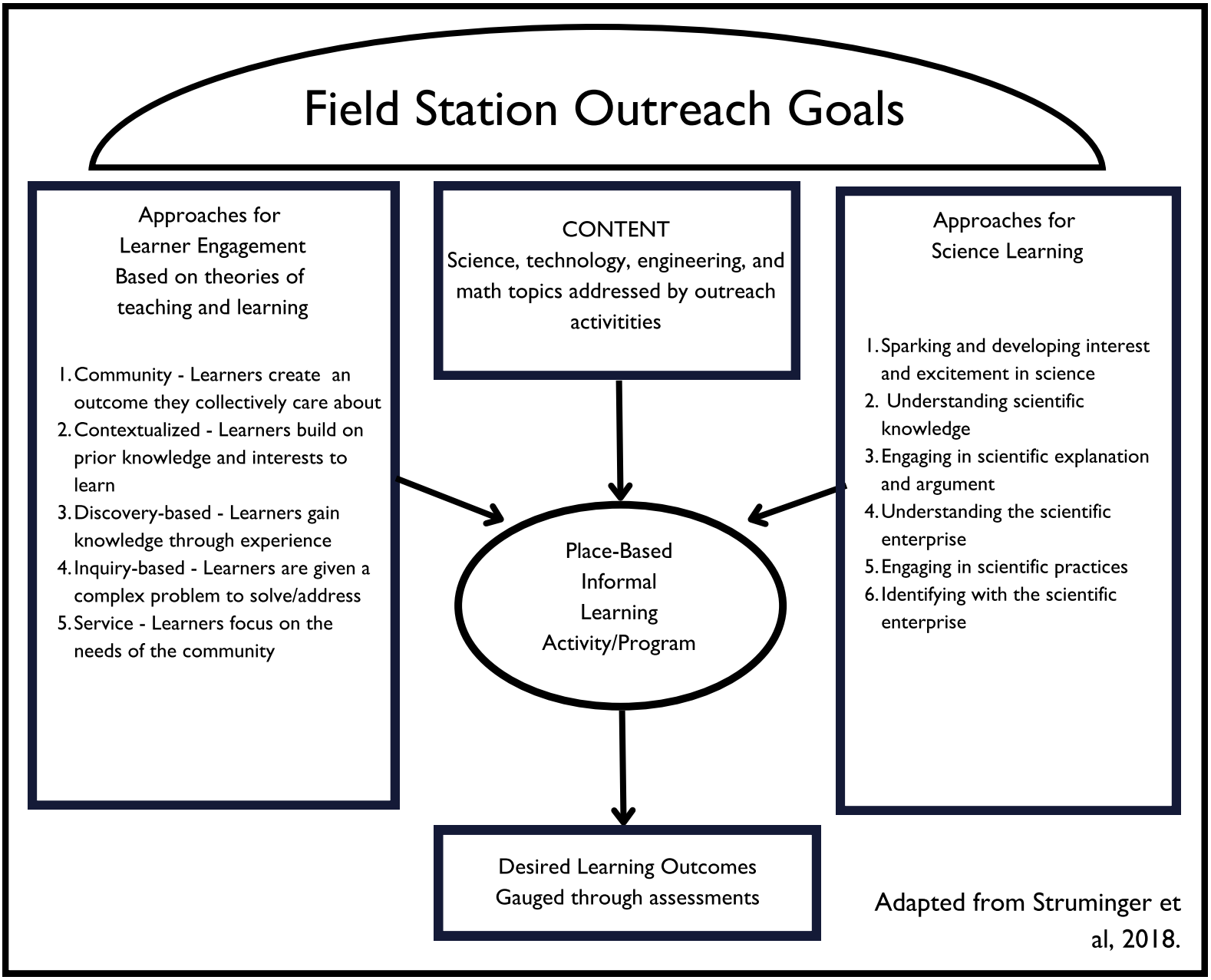
Education Program develops virtual programs, produces in-house education videos, and collaborates in virtual learning statewide and nationally.

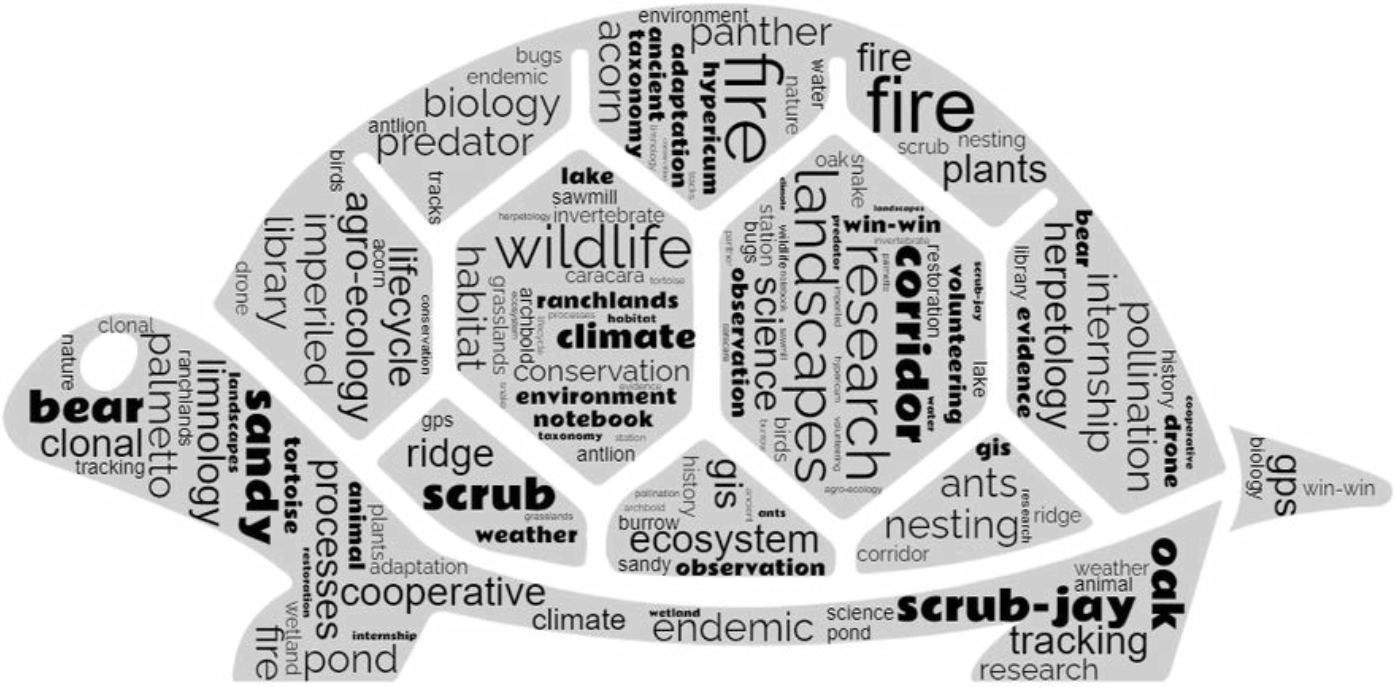
6 BUILDING CAPACITY 2022 - CURRENT

- Dustin Angell appointed to Program Director of Education
- Katie Caldwell hired as part-time Education Assistant
- Program begins to work regularly with board members

FIELD STATION EDUCATIONAL OUTREACH FRAMEWORK

Our Education Program utilizes the framework for educational outreach at field stations proposed by Struminger et al (2018). Our educational outreach activities are not scaled enough to encompass everything in this framework, nor limited to science learning goals, but it acts as a best practice guidepost for our science teaching.





TEACHING SCIENCE, CONSERVATION, AND HISTORY

The word cloud above shows examples of common topics in our educational outreach activities for K-12 and public audiences. While not a comprehensive list, a cursory glance gives an approximate picture of what our students and audiences learn about.

We draw from the research of our staff and collaborators in areas including: Agro-ecology, Avian Ecology, Conservation, Evolutionary Biology, GIS/Data Management, Herpetology, Restoration Ecology, Invertebrate Ecology, Library/Archives, Land Management (Fire & Invasives), Limnology, Plant Ecology, and Predator/Prey.

Since 2022, we are emphasizing Archbold's 4 strategic pillars: saving the rarest of the rare, sustaining grasslands, connecting large landscapes and wildlife corridors, and addressing climate change.

ARCHBOLD'S EDUCATIONAL OUTREACH ACTIVITIES

Below is a list of our educational outreach activities for K-12 and public audiences. As a place-based organization, it is important to note where the activities take place: onsite, offsite, or online.

Location of Archbold's Educational Outreach Activities				
Audience	Activities	Onsite	Offsite	Online
K-12 Students	Elementary School Field Trips	★		
	Other K-12 Field Trips	★		
	Summer Camp	★		
	K-12 School Visit		★	
	Virtual Class Visit			★
	Online Classroom Resources			★
	Science Fair Judging		★	
Children and Adults	Selfie-stick Tour			★
	Community Festival		★	
	Family Public Event	★		
Adults	Invited Presentation		★	★
	Adult Public Event (non-academic lectures and open houses)	★	★	★

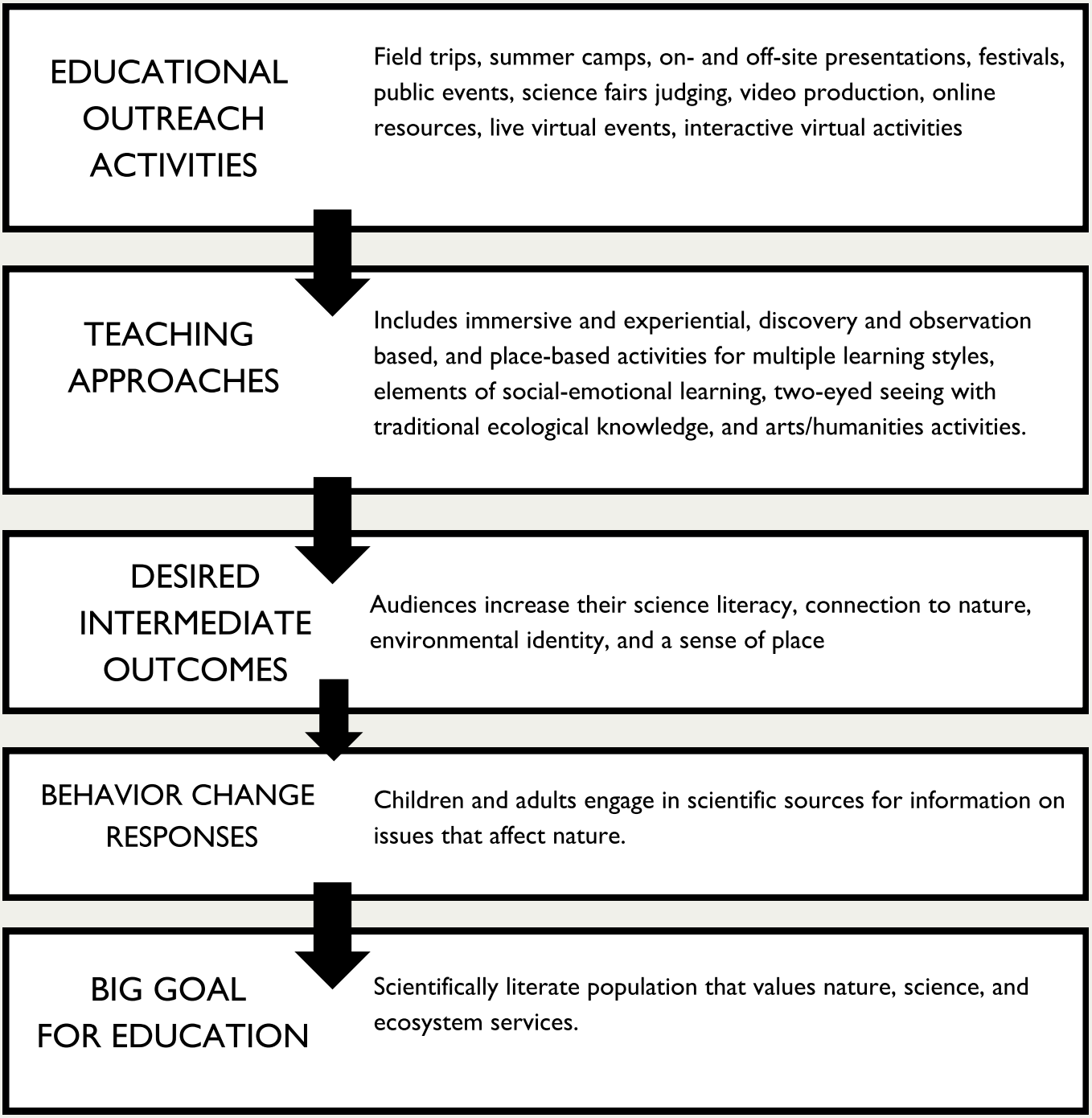
ARCHBOLD'S EDUCATIONAL OUTREACH ACTIVITIES

Below is a list of our educational outreach activities for K-12 and public audiences. this table shows different elements involved in outreach activities.

Elements of Archbold's Educational Outreach Activities						
Audience	Activities	Outdoor Laboratory	Indoors	Booth	Interact with a Researcher	Includes Arts/Humanities
K-12 Students	Elementary School Field Trips	★	★			
	Other K-12 Field Trips	★	★			
	Summer Camp	★	★		★	★
	K-12 School Visit		★			
	Virtual Class Visit		★			
	Online Classroom Resources					★
	Science Fair Judging		★			
Children and Adults	Selfie-stick Tour				★	★
	Community Festival			★		
	Family Public Event	★	★		★	★
Adults	Invited Presentation		★			★
	Adult Public Event (non-academic lectures and open houses)	★	★	★	★	★

THEORY OF CHANGE

The diagram below outlines a theory of change designed to support Archbold's mission by encouraging science literacy, connection to nature, environmental identity, and a sense of place. Archbold is only one part of the learning ecosystem that includes in- and out-of-school experiences and a myriad of social factors.



OUTCOMES

The Education Program's theory of change is a forward-looking plan that shows how our educational outreach activities ultimately support the big goal of a scientifically literate population that values nature, science, and ecosystem services. The framework for education at field stations proposed by Struminger et al (2018) is a valuable guide for our teaching approaches (e.g., experiential and place-based learning); however, research shows that scientific knowledge is a weak indicator of behavior change. Because we are interested in supporting conservation as well as science literacy, we have used Krasny's (2020) Advancing Environmental Education Practice to identify three intermediate outcomes as indicators of future behavior change: connection to nature, sense of place, and environmental identity.

CONNECTING TO NATURE

"Nature connectedness is a feeling of being connected and belonging to the natural community. (Krasney, 2020)."

SENSE OF PLACE

"Sense of place refers to the meanings and emotions we associate with a particular place (Krasney, 2020)."

ENVIRONMENTAL IDENTITY

"Sense of connection to some part of the nonhuman natural environment that affects the way we perceive and act toward the world; a belief that the environment is important to us and an important part of who we are (Clayton 2003, 45–46)."

ASSESSMENT

We measure a variety of indicators of success for our education outreach activities. This includes documenting participation numbers, gathering participant feedback on our teaching practices, and measuring intermediate outcomes. These data demonstrate our commitment to community outreach and science education, but they also allow us to track indicators of success, like improvements in a student's sense of place.

Types of Assessments

1. Activities facilitated and associated attendance levels. This continues a decades-old data-set.
2. Online Feedback: Solicited through emails after online events.
3. Informal Assessments: During low-intensity activities (less than a weeklong), we solicit and record verbal feedback on what participants learned and liked most. It is not recommended to conduct pre- and post-activity surveys on low-intensity activities (Kersey, 2020).
4. Agile Assessments: Iterative verbal assessment process done through staff discussions after most educational outreach activities.
5. Pre- and post-surveys at summer camp. These week-long programs are considered medium-intensity, making them a good candidate for pre- and post- surveys. After testing differing survey tools, we have adopted the Children's Environmental Perceptions Scale, designed for (6–13 years). We could not find assessments in the age group that exactly matched our three desired intermediate outcomes, but we've determined that this assessment tool is closely correlated.
6. Creative qualitative feedback: Some lessons, like artwork and writing assignments (e.g., #MyScienceFuture) can be used as qualitative assessments.

CHILDREN'S ENVIRONMENTAL PERCEPTIONS SCALE

Text below from Salazar et al's Practitioner Guide to Assessing Connection to Nature (2020)

What This Tool Measures

The Children's Environmental Perceptions Scale (CEPS) was designed to measure younger children's perceptions of nature (Larson, Green, & Castleberry, 2011). Specifically, the tool measures a child's personal interest in nature (eco-affinity) and a child's attitudes toward and concern about environmental issues (eco-awareness). The CEPS was tested and validated with African American, Hispanic, and non-Hispanic White children to ensure that it can measure perceptions of nature among diverse audiences.

Tips for Using This Tool

The authors recommend reading each statement aloud while children respond on paper copies of the questionnaire by circling the symbol that best reflects their feelings. In the original study, the authors read each question aloud twice. They recommend giving children 20–30 seconds to respond to each item. Following these guidelines, approximately 15 minutes are needed for children to complete the CEPS. The tool was used as a pretest and posttest evaluation tool for a one-week environmental education program (Larson, Castleberry, & Green, 2010). On average, children who attended the environmental education program scored higher in both eco-affinity and eco-awareness than children in the control group, who did not attend an environmental education program.

Children's Environmental Perceptions Scale

	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
1. I like to learn about plants and animals.					
2. Plants and animals are important to people.					
3. I like to read about plants and animals.					
4. Plants and animals are easily harmed or hurt by people.					
5. I am interested in learning new ways to help protect plants and animals.					
6. People need plants to live.					
7. My life would change if there were no trees.					
8. I would give some of my own money to help save wild plants and animals.					
9. I would spend time after school working to fix problems in nature.					
10. We need to take better care of plants and animals.					
11. I like to spend time in places that have plants and animals.					
12. It makes me sad to see homes built where plants and animals used to be.					
13. I like to learn about nature.					
14. I would help to clean up green areas in my neighborhood.					
15. Nature is easily harmed or hurt by people.					
16. My life would change if there were no plants and animals.					

Thanks for your help!

Source: Larson, L. R., Green, G. T., & Castleberry, S. B. (2011). Construction and validation of an instrument to measure environmental orientations in a diverse group of children. *Environment and Behavior*, 43(1), 72-89.

SECTION TWO

Looking Forward

LOOKING FORWARD

Archbold has offered high quality environmental education to local communities for decades. With only one full-time staff (plus short-term interns and volunteers) and most programs offered free-of-charge, the Education Program's costs were low and mostly covered by the organization. However, the Program's new virtual resources, demand for in-person programs, a push toward statewide audiences, expansion into middle schools, more partner collaborations, emphasis on evaluations, and the new directive to support Archbold's conservation goals necessitate a larger staff and budget. To start this process, Archbold hired a part-time Education Assistant in Fall 2022. Moving forward, the Program Director of Education must become an efficient fundraiser. He will need the support of staff, board members, and partners to succeed in this new area.

PROGRESS OF OUR PROJECT

Dustin Angell,
Program Director of Education

Katie Caldwell,
Education Assistant

Archbold's Education Program staff currently consists of 1) a Program Director, 2) a full-time Education Assistant (30 hours/week), 3) a part-time intern for 7-9 months, and 4) a couple dozen volunteers. The annual budget for the Education Program is around $165,000.

Funding Sources (2024)

- Archbold General Funds
- Restricted Giving ($20K-$40K)
- Tour and camp profits (~$10K)
- Grants/partnerships (~$2,000)

Return on Investments

Archbold's Education Program's value, including from educational outreach activities for K-12 and public audiences, is not derived from monetary revenue. ROI can be expressed by impacts.

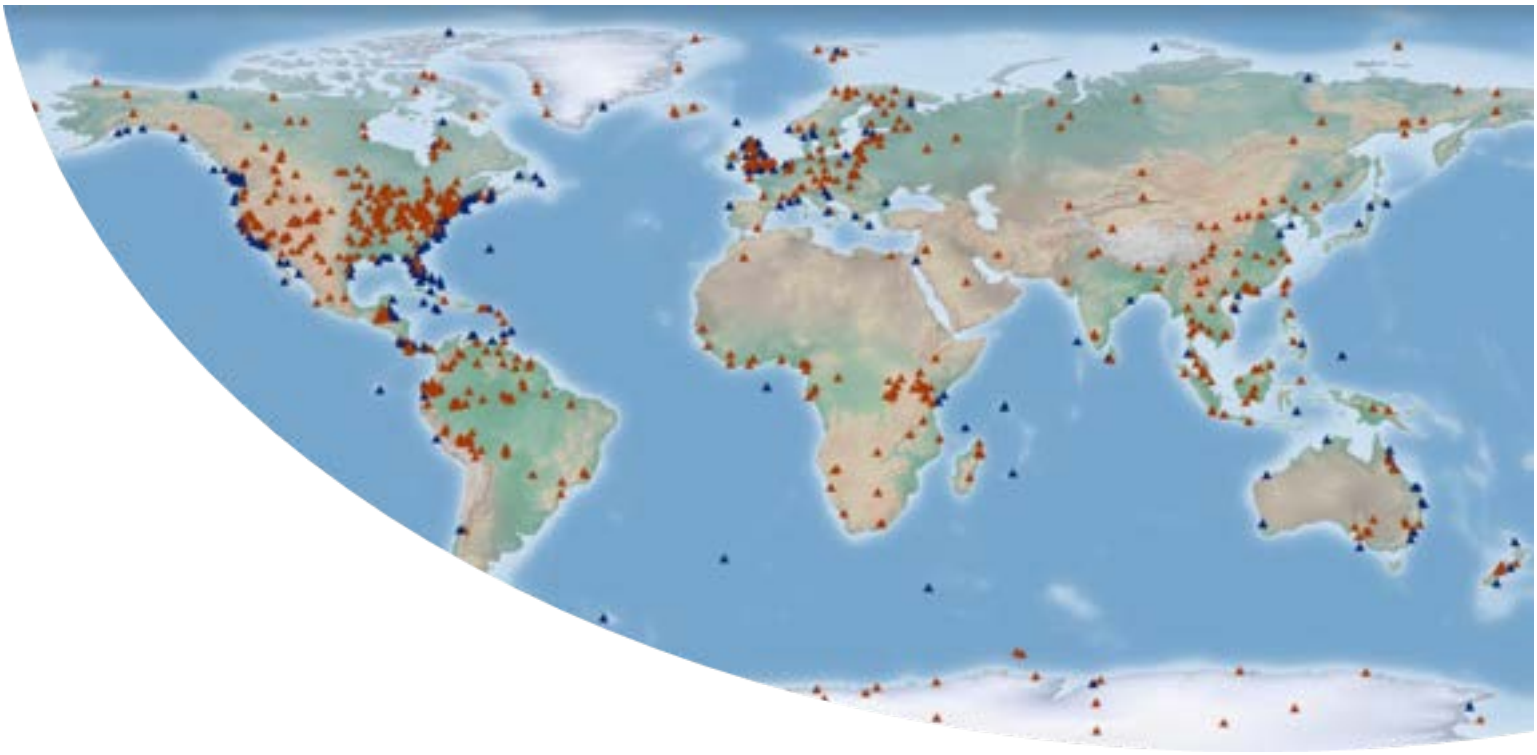
CURRENT POSITIVE IMPACTS FOR ARCHBOLD

Part of Archbold's mission	Reaches ~4,000 K-12 students and public annually through in-person programming (Highlands, Polk, and Okeechobee Counties)
Reaches thousands annually through virtual education	Provides one of few science education resources for local rural community
Satisfied education components of large federal research grants	Enhances value of research internship experience when they assist in activities
Builds name recognition and trust from the local community	Photos and stories have wide donor appeal
Volunteer Program (run through Education Program) contributes volunteer hours equal to 2-3 full-time staff annually	Program Director contributes regularly to high-level organizational decision-making
Program Director builds relationships with donors and other special guests	Co-responsible with Human Resources for organizational initiatives in community and culture
Participates in regional and statewide networks of educators and researchers to build capacity and reach for Archbold	Graduates 1-2 environmental education interns annually

POSSIBILITIES

The Program Director of Education must put more emphasis on fund-raising in order to expand our reach, assess our programs, and more fully support Archbold's 4 pillars. The Program's relatively small and stable budget puts it in a positive position to carefully choose funding opportunities that best meet its needs.

Strategic Plan Pathway		
Opportunity	Need	Future Impact
Expand Education Assistant position from 30 to 40 hours/week	A small staff limits program resilience , utilization of our skills, and ability to reach all the counties in the Headwaters of the Everglades.	1) Resumed production of collaborative video series with science staff. 2) Improved outreach of underserved local communities. 3) PD can focus increasingly on administration, partnerships, and fundraising, 4) Ability to expand our in-person school programs from elementary schools to include middle schools.
Hire a part-time volunteer coordinator	The volunteer program is underutilized as staff time dedicated to managing it is limited. This limits the capacity of the organization, but also contributes to landscaping and trail maintenance issues.	A robust volunteer program that ensures a fantastic experience for walk-in visitors, helps throughout the organization, and enhances community relations. This volunteer base is also a donor pool.
Engage in virtual activities statewide	Our on-site capacity is limited by space and facilities, but our potential for expanding statewide, though online learning, is enormous. We currently focus on Highlands, Polk, and Okeechobee Counties.	1) Florida teachers are trained in Archbold's online resources and learning modules. 2) Archbold's research and conservation form the backdrop for science learning in schools across the state.
Seek funding for evaluation	In recent years, the Education Program has produced innovative projects, like #MyScienceFuture and My Florida Explorers, but we can't make claims about their effectiveness without professional evaluation.	1) We understand the value of our innovative projects, which positions us for funding, scalability, and publication. 2) Broadcast Archbold-based projects as a model for innovative education activities nationwide.
Inter-partner programming through contracts	Our Education Program's high-quality activities and resources, and long-term regional relationships, well position us to develop and deliver partner content that aligns with our mission.	1) Funds from contracts will help fund current staff and possibly new staff. 2) By speaking as one voice with our partners we amplify our messages.

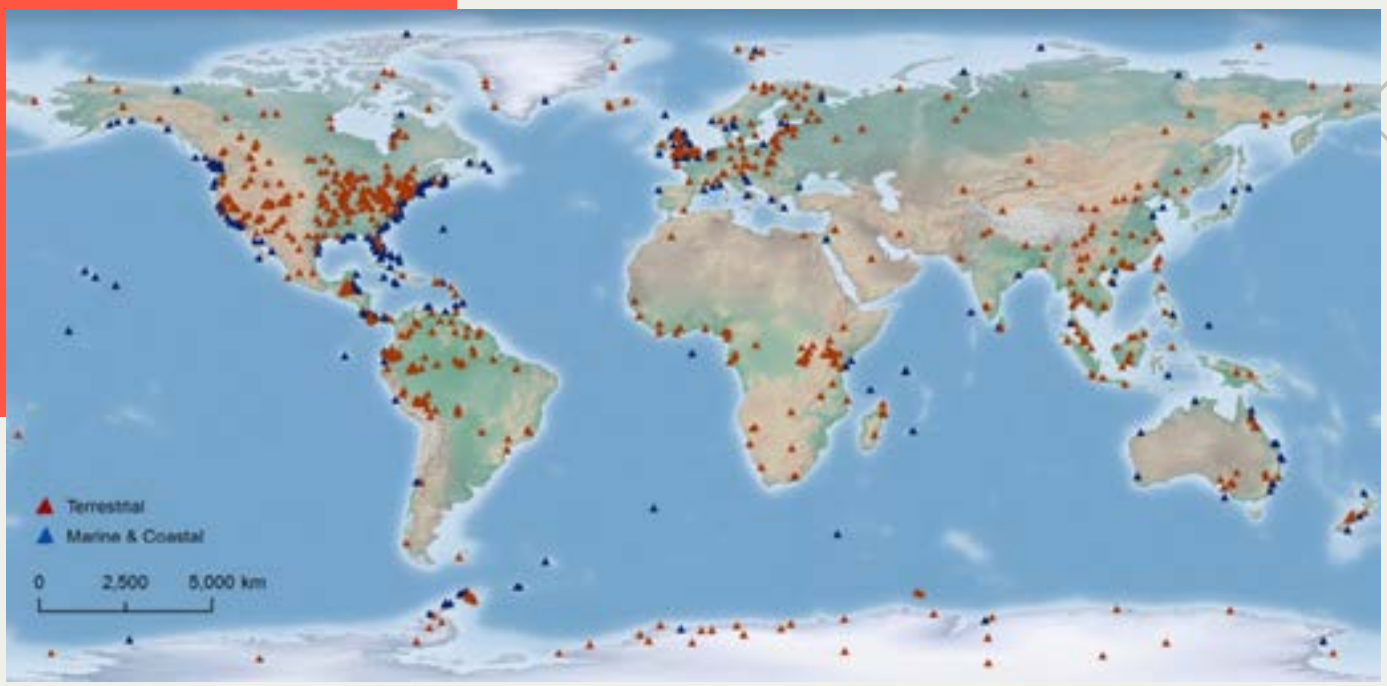


SECTION THREE:

Overview of Education Theory

OVERVIEW OF EDUCATION THEORY

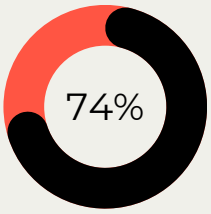
Archbold's educational outreach activities for K-12 and public audiences can be understood within the educational context of field stations and environmental education. To effectively educate and make use of their special resources – land and science research – field stations offer science content through immersive place-based lessons. Also, with student exposure to science, ecologist role models, and natural areas, we can also address misconceptions and the difficulty Florida students have in understanding the Nature of Science. As environmental educators, Archbold is also interested in fostering environmental literacy and a conservation mindset to confront the urgent environmental problems globally, nationally, and regionally. As part of familiarizing students with the land, we can draw from and acknowledge millennia of Indigenous stewardship. Incorporating non-Western perspectives and emotional-social aspects of connection to place creates engaging activities and lifelong memories.



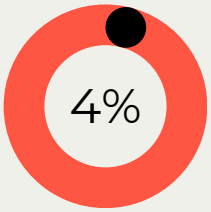
Map showing locations of 963 field stations worldwide. (NRC, 2014)

WHAT IS A FIELD STATION?

"A field station is a center of scientific research, conservation, education, and outreach that is embedded in the environment in a location that is usually protected and that serves both the local community and the larger scientific community. The research conducted at a field station is often focused on local environmental regions, but national and international scientific projects are common (NRC, 2-14)."



74% of US field stations are part of universities



Only 4% of US field stations are independent field stations

NAML-OBFS, 2013

According to Tydecks et al (2016) there are over 1,200 field stations worldwide, 32.8% are in North America, and 300+ are in the United States.

WHAT IS OBFS?

The Organization of Biological Field Stations, founded in 1966, is the professional association representing field stations and marine laboratories across North America and beyond. Many members also belong to the National Association of Marine Laboratories.
(McNulty et al, 2017)

In the late 19th century, North America's first field stations arose in tandem with the nascent field of ecology, so that biologists could get outside the laboratory and study organisms in their natural environments. (Kohler, 2002; De Bont, 2015)

ARCHBOLD IS AN OBFS LEADER

BOARD MEMBERS

Archbold is a founding member of OBFS in 1966 (represented by James Layne). Hilary Swain (Archbold Executive Director) and Mary Hufty (recent Archbold Board Chair) are both long-term active OBFS members.

EDUCATIONAL OUTREACH & PROFESSIONAL DEVELOPMENT

In 2020, Archbold became founding members of The Virtual Field, a group of OBFS member sites who, with National Science Foundation support, work together on virtual education projects. Dustin Angell contributes as a content creator, videography trainer, and tech support for participating field sites. Dustin also participated in the inaugural Station Exchange program in 2023, wherein he worked at the Sitka Sound Science Center for two weeks.

FIELD STATION LEARNING LANDSCAPE

In 2013, the Organization of Biological Field Stations published a strategic vision document for the future of field stations and marine laboratories. Three of the goals listed in the document (see below) are reminders that educational outreach activities are vital to the value of field stations.

Goal 1

Increase the value to society of the science done at [field stations and marine laboratories], as well as the public understanding of that value.

Goal 3

Enhance the synergies between research and education.

Goal 4

Promote the flow of scientific information for environmental stewardship by ensuring appropriate access by scientists and students to terrestrial, aquatic, and marine systems.

Text copied from: OBFS, 2013

Researcher Amanda West during a tour for the Ecological Society of America.

FIELD STATION LEARNING LANDSCAPE

In 2014, the National Research Council released a report on enhancing the value of field stations. We recognize three of these education related recommendations (see below) as touchstones when making decisions about program development, partners, and resource allocation.

Science for an Unpredictable World

Field station leaders should identify and support the development of scientific and educational assets that harness their stations' unique qualities to address local, regional, national, and global challenges by bringing together scientists from a number of disciplines, including the social sciences, through what we now call convergence.

Networking for Discovery and Innovation

Field stations should seek opportunities for networking that make scientific, educational, and business sense. Universities and funding organizations should provide incentives for networking of field stations that meet those criteria. National Science Foundation and other funding agencies could encourage networking of field stations through the request -for-proposal process by giving preference to proposals that link multiple field stations.

Empowering Through Engagement

Field stations should continue to explore a wide range of approaches to engage the public in science, and select and tailor their activities in a manner that best leverages a field station's location, personnel, infrastructure, and other available resources. Empirically based approaches in science communication and informal education should be used to guide the development and assessment of engagement activities to promote public understanding of science effectively.

Text copied from: NRC, 2014

FIELD STATION OUTREACH

Struminger et al (2018) surveyed 25 US field stations about their education outreach programs and proposed an education framework . Archbold's activity types and goals closely resemble those from the other field stations, matching all but one, "summer youth internship," which we sometimes had in the past. Below are the rest of the activities and goals on Struminger's list.

Reported Outreach Activity Types

- General science seminars
- Camps
- Lecture series
- Community events
- Family science programs
- Citizen science projects
- Hands-on workshops
- Station open houses
- Nature walks
- Demonstrations of research

GOALS

Archbold's outreach goals match the ones recorded by Struminger et al (2018).

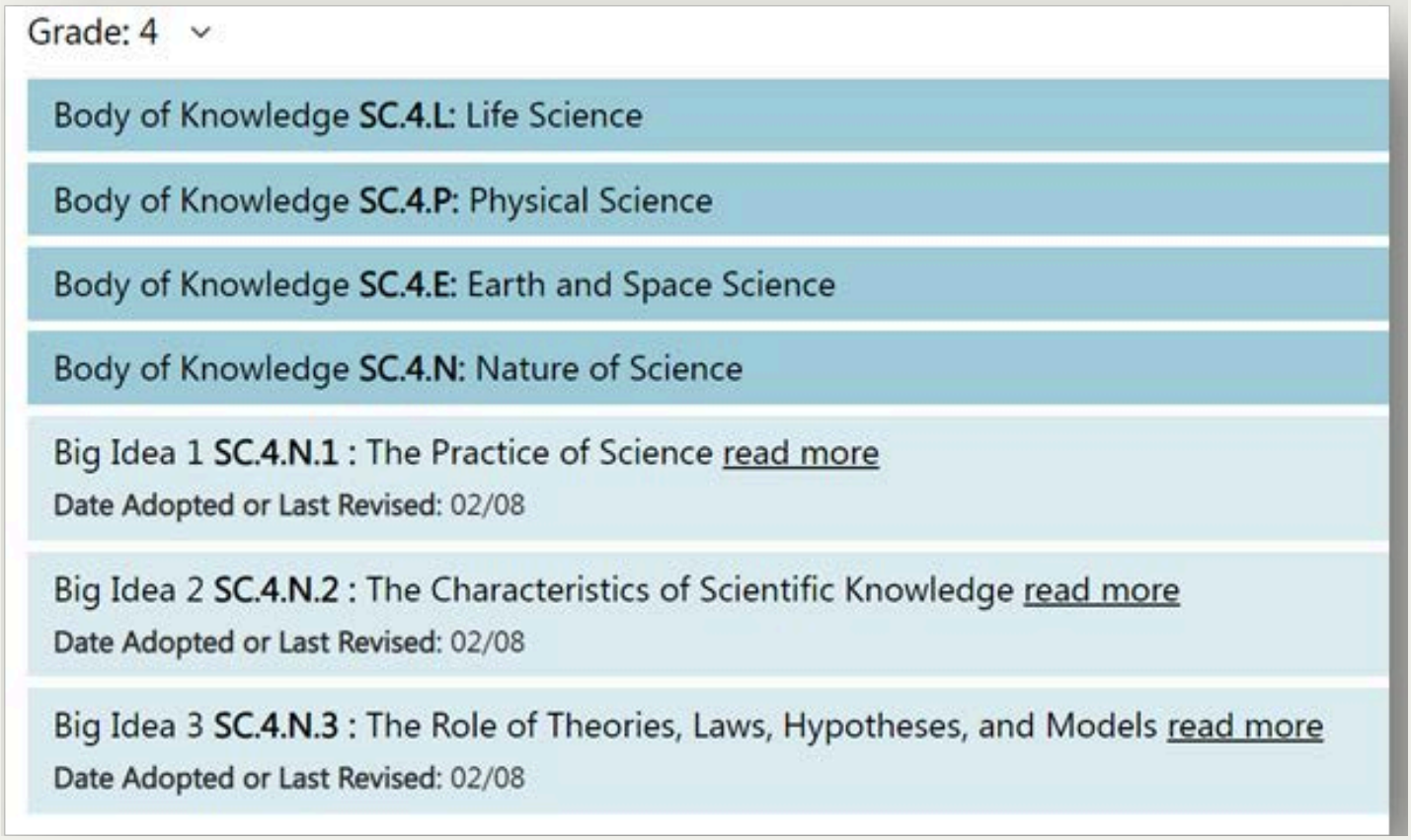
- Reach a particular audience
- Disseminate knowledge and skills
- Teach about the environment generally
- Encourage conservation or environmental stewardship
- Build community
- Raise awareness of the field station's work
- Make field station resources available to the public
- Motivate STEM careers
- Inspire curiosity

FIORIDA SCIENCE STANDARDS

In statewide testing of science knowledge by the Florida Department of Education, less than half the 5th grade and 8th grade students achieved passing scores in 2021.

In 2021, students performed poorly in all four science content areas, with 5th graders showing the most difficulty in the Nature of Science category.

Misconceptions about the nature of science are found throughout schools nationwide. Sandoval (2015) summarizes the literature on student science understanding and presents four areas of difficulty for students, including: 1) that science is constructed by people, 2) That science varies in certainty, 3) that a diversity of methods are used in science, and 4) that there are different forms of scientific knowledge.



Screenshot from CPALMS.org, showing 4th grade science standards

ARCHBOLD SUPPORTS THE STANDARDS

Archbold's educational outreach programs, which expose children to scientists and research methods, aims to help address students' understanding and low pass rates in the "Nature of Science" and other science standards.

% of Students Who Passed the 2021 Statewide Science Assessment				
Student Group	Nature of Science	Earth and Space Science	Physical Science	Life Science
5th Grade Statewide	60%	63%	69%	64%
5th Grade Highlands County	55%	60%	60%	60%
8th Grade Statewide	60%	63%	69%	64%
8th Grade Highlands County	60%	63%	69%	71%

Celebrating Environmental Education: Tbilisi+40
https://youtu.be/7wzIKwyYXIw

WHAT IS ENVIRONMENTAL EDUCATION?

Environmental education (EE) is a process that helps individuals, communities, and organizations learn more about the environment, and develop skills and understanding about how to address global challenges. It has the power to transform lives and society. It informs and inspires. It influences attitudes. It motivates action.

Key Concepts in Environmental Education

- Focus on systems thinking
- Lifelong learning: cradle to grave
- Equity & Inclusion
- Focus on sound science
- Built on a sustainability platform
- Interdisciplinary
- Sense of place
- Reflects best practice in education (learner-centered, experiential, and project-based learning)
- Informed decision making

Definition and concepts from the website of:
North American Association for Environmental Education

Archbold's Education Program has long identified its educational outreach activities as, but not limited to, environmental education.

ENVIRONMENTAL EDUCATION GROUPS

Archbold is a member of three environmental education groups, the North American Association for Environmental Education (NAAEE), the League of Environmental Educators in Florida (LEEF), and the Southeastern Environmental Education Alliance (SEEA).

NAAEE

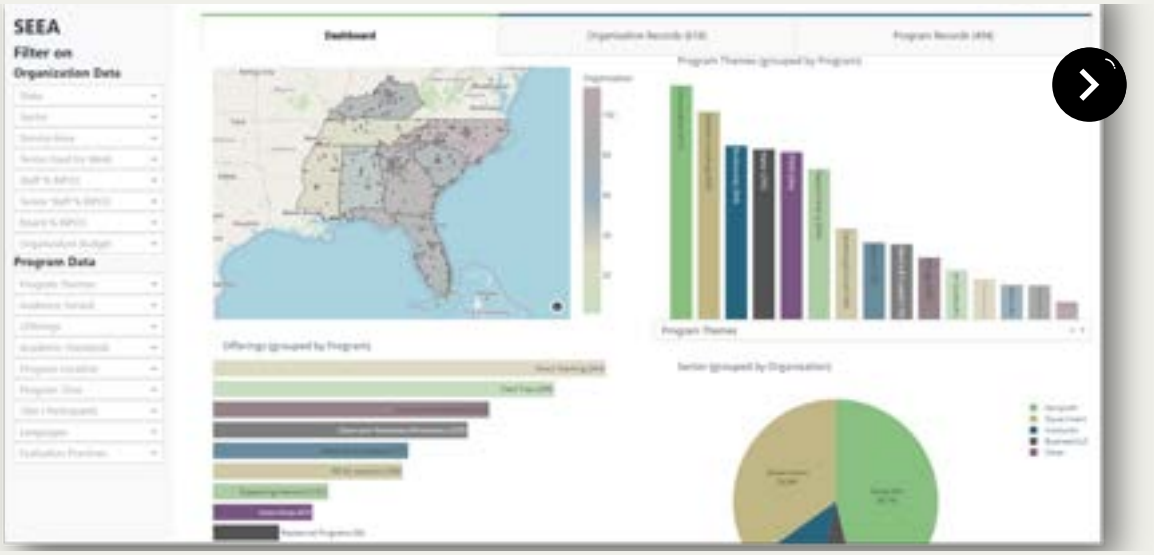
NAAEE is the professional association representing environmental educators across North America. Conferences typically have 1,000+ attendees.

SEEA

SEEA is a network of NAAEE state affiliates from the Southeast, including LEEF.

LEEF

LEEF is the professional association for environmental educators in Florida. LEEF has 200+ members and is a state affiliate of NAAEE. Archbold has decades-long participation with LEEF. Dustin Angell has served as President twice, overseeing three conferences and directing a re-branding of the organization.



Screenshot of interactive landscape analysis.
Visit site to see details.

SOUTHEASTERN ANALYSIS

In 2021, the Southeastern Environmental Education Alliance conducted a landscape analysis of environmental education in the Southeast, including surveying 646 organizations across 8 states, and created a free interactive online dashboard. The following analysis results also apply to Archbold's educational outreach activities:

- Predominant program themes: conservation, outdoor learning, biodiversity, water, and STEM
- Primary offerings are direct teaching and field trips
- Primary audience is K-5 students
- In addition to environmental education, providers identified their programs as outdoor education, conservation education, and nature-based learning.
- Limited evaluation of programs (support, training, and tools needed)
- Few providers collect demographic data on their audiences
- Starting salaries for EE practitioners are less than classroom teachers or for jobs in forestry or hospitality and tourism.

Analysis results copied from SEEA website: https://www.southeastee.org/landscape

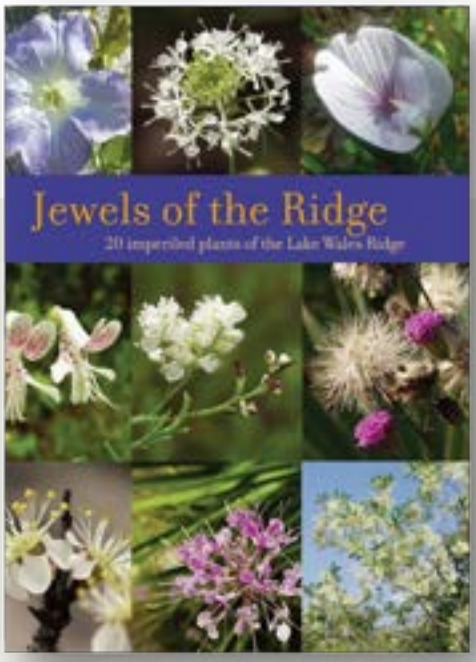
GLOBAL CHANGE

Archbold's Education Program can be understood within the context of ecological change at global and regional scales. Major international reports and other research detail declines in biodiversity and ecosystem services, and the impacts of climate change. The latest climate report from the Intergovernmental Panel on Climate Change (IPPC, 2022) warns that some climate change impacts to nature and society are already irreversible and that worse is to come.

In 2019, the first intergovernmental assessment of biodiversity and ecosystem services (IPBES) found that threats to both intensified in just the last 15 years before publication: environmental change is accelerating. They conclude that nearly 25% of plants and animal species are at risk of extinction – that is 1 million species at risk.

A major research paper from the Cornell Lab of Ornithology and their collaborators (Rosenberg et al, 2019) announces that North American has nearly 3 billion less birds than it did in 1970.

These environmental problems, and others, precipitate declines in the ecosystem services humans rely on (IPBES, 2019); in the IPBES's report, 15 out of their 18 identified ecosystem services were in decline.



Article describing the endemic species of the ridge. Weekley & Denton, 2006.

Lake Wales Ridge

The overwhelming majority of Archbold's educational outreach activities for K-12 and public audiences currently take place on the Lake Wales Ridge and involve the Florida scrub habitat. The ridge has 21 of Florida's 70 Federally protected plant species and, according to Noss & Peters (1995), has "some of the greatest densities of endemic plants of any continental habitat in the world." In their assessment of ecosystems across the US, they identified the Florida scrub as the 15th most endangered. By the early 2000's, an estimated 85% of the upland habitats of the ridge were gone (Turner et al, 2006).

"As an immigrant culture, Americans must start to engage in their own process of becoming indigenous to this place and regain their roles as members of the ecological community. If bringing traditional ecological knowledge to its rightful place in science education can move us toward that goal, then we will all be richer for the effort."

Robin Kimmerer, 2002

Cultural Landscape

Natural lands are also cultural lands. Archeological evidence confirmed human ancestors in Florida over 14,000 years ago (Halligan et al, 2016) and in the general vicinity of Archbold 6,000 years ago (Butler, 2008). International assessments find that land managed by Indigenous people and local communities, in general, is in better ecological health than others (e.g., IPBES, 2019; Toledo, 2001), and they recommend inclusion of Indigenous peoples in efforts toward climate resilience and biodiversity protection (e.g., IPCC, 2022; UNEP, 1998). Worldwide, the homelands of Indigenous peoples include 80% of the world's biological hotspots (Toledo, 2001).

Traditional Ecological Knowledge

The long history of successful land stewardship is the result of a worldview that sees humans, the more-than-human world, and the spiritual world as deeply interrelated. This worldview, requiring reciprocity and mutual obligations, is found widely in Indigenous philosophies. The term Traditional Ecological Knowledge (TEK) refers to a "cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (Berkes, 1998:9)." The United Nations (UNEP, 1998), in reference to biodiversity conservation goals, declared that "traditional knowledge should be given the same respect as any other form of knowledge." Also, as Archbold is a place-based research institution practicing ecology, we are better aligned with TEK than urban scientific institutions.

BRIDGING THE KNOWLEDGE SYSTEMS

Indigenous thinkers propose that Traditional Ecological Knowldege and western science need not compete but should complement each other; we need both systems to meet the environmental challenges that face us.

The Mi'kmaq Elder, Albert Marshall of Eskasoni First Nation, coined the term "Two-Eyed Seeing," which "refers to the mindful effort of learning to see from our one eye with the strengths of the Indigenous knowledges and ways of knowing while also learning to see from our other eye with the strengths of the Western (or mainstream, or Eurocentric, or conventional) scientific knowledges and ways of knowing… (Bartlett, 2006)."

Gloria Snively, a non-Indigenous education scholar illustrates the idea with the metaphor of "braiding" together Indigenous and Western Sciences; like braiding baskets, bracelets, and hair, "each strand remains a separate entity, a certain tension is required, but all strands come together to form the whole (Snively, 2018).

In our educational outreach activities, we can practice two-eyed seeing by introducing Seminole species names, history, and perspectives into some of our lessons.

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